

Coating material and its use for producing highly scratch-resistant multicoat clearcoat systems

**Claims**

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1. A coating material curable thermally and, if desired, with actinic radiation, comprising

10 A) at least one binder containing at least two functional groups (a1) which are able to undergo thermal crosslinking reactions with complementary functional groups (b1) in the crosslinking agent (B), and

15 B) at least one crosslinking agent containing at least two functional groups (b1) which are able to undergo thermal crosslinking reactions with the complementary functional groups (a1) in the binder (A),

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and also, if desired,

25 C) at least one constituent which is crosslinkable with actinic radiation,

D) at least one photoinitiator,

E) at least one thermal crosslinking initiator,

F) at least one reactive diluent curable with actinic radiation and/or thermally,

5 G) at least one coatings additive, and/or

H) at least one organic solvent,

10 characterized in that at least one binder (A) contains in copolymerized form at least one olefinically unsaturated polysiloxane macromonomer containing on average per molecule at least 3.0 double bonds.

15 2. The coating material as claimed in claim 1, characterized in that the polysiloxane macromonomer contains on average per molecule at least 4.0, with particular preference at least 5.0, and in particular at least 5.5 double bonds.

20 3. The coating material as claimed in claim 1 or 2, characterized in that the polysiloxane macromonomer contains on average per molecule up to 10.5, preferably 9.0, with particular preference 8.5, and in particular 8.0 double bonds.

25 4. The coating material as claimed in any of claims 1 to 3, characterized in that the polysiloxane

macromonomer contains on average per molecule from 5.5 to 6.5, in particular 6.0, double bonds.

5. The coating material as claimed in any of claims 1 to 4, characterized in that the polysiloxane macromonomer has a number-average molecular weight  $M_n$  of from 500 to 100 000, preferably from 1 000 to 50 000, with particular preference from 2 000 to 30 000, and in particular from 2 500 to 10 20 000 daltons.

6. The coating material as claimed in any of claims 1 to 4, characterized in that the polysiloxane macromonomer is in three-dimensionally crosslinked form.

7. The coating material as claimed in any of claims 1 to 5, characterized in that the polysiloxane macromonomer is an alkyl-, cycloalkyl-, alkyl-20 aryl-, alkyl-cycloalkyl-, cycloalkyl-aryl- or arylsiloxane resin.

8. The coating material as claimed in claim 6, characterized in that the alkyl radicals contain from 1 to 10, with particular preference from 1 to 5, and in particular from 1 to 3 carbon atoms, the cycloalkyl radicals contain from 3 to 10, with particular preference from 4 to 8, and in particular from 5 to 7 carbon atoms, and the aryl

radicals contain from 6 to 12 and, in particular, from 6 to 10 carbon atoms.

9. The coating material as claimed in claim 6 or 7, 5 characterized in that it comprises an alkylsiloxane resin, in particular a methylsiloxane resin.
10. The coating material as claimed in any of claims 1 10 to 8, characterized in that the polysiloxane macromonomer contains, as groups having olefinically unsaturated double bonds, acrylic, methacrylic, ethacrylic, vinyl, allyl and/or crotonyl groups, with particular preference 15 acrylic, methacrylic and vinyl groups, and especially acrylic groups.
11. The coating material as claimed in any of claims 1 20 to 9, characterized in that at least one of the binders (A) contains in copolymerized form up to 15% by weight, preferably up to 10% by weight, with particular preference up to 5% by weight, and in particular up to 2% by weight, based in each case on the binder (A), of at least one polysiloxane macromonomer according to any of 25 claims 1 to 9.
12. The coating material as claimed in any of claims 1 to 10, characterized in that at least one of the

binders (A) contains in copolymerized form at least 0.01% by weight, preferably at least 0.05% by weight, with particular preference at least 0.08% by weight, and in particular at least 0.1% by weight, based in each case on the binder (A), of at least one polysiloxane macromonomer according to any of claims 1 to 9.

13. A multicoat clearcoat system KL for a primed or  
10 unprimed substrate, producible by

(1) applying at least one clearcoat film I of a coating material I curable thermally and, if desired, with actinic radiation to the surface of the substrate and

15 (1.1) partly or  
(1.2) fully

20 curing it, and

(2) applying a further clearcoat film II of a coating material II curable thermally and, if desired, with actinic radiation to the surface of the clearcoat film(s) I

25 (3) and then curing

(3.1) the clearcoat films I and II together

or

(3.2) the clearcoat film II alone,

5 thermally and, if desired, with actinic  
radiation

10 characterized in that the coating material II  
and/or the coating material I, especially the  
coating material II, is a coating material as  
claimed in any of claims 1 to 11.

14. A process for producing a multicoat clearcoat  
system KL on a primed or unprimed substrate by

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(1) applying at least one clearcoat film I of a  
coating material I curable thermally and, if  
desired, with actinic radiation to the  
surface of the substrate and

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(1.1) partly or  
(1.2) fully

curing it, and

25

(2) applying a further clearcoat film II of a  
coating material II curable thermally and, if  
desired, with actinic radiation to the  
surface of the clearcoat film(s) I

(3) and then curing

(3.1) the clearcoat films I and II together

5

or

(3.2) the clearcoat film II alone,

thermally and, if desired, with actinic  
radiation

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characterized in that the coating material II  
and/or the coating material I, especially the  
coating material II, is a coating material as  
claimed in any of claims 1 to 11.

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15. A multicoat color and/or effect paint system ML  
for a primed or unprimed substrate, producible by

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(1) applying at least one color and/or effect  
basecoat film III of a pigmented coating  
material III curable thermally and, if  
desired, with actinic radiation to the  
surface of the substrate, and drying it  
without curing,

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(2) applying at least one clearcoat film I of a  
coating material I curable thermally and, if  
desired, with actinic radiation to the  
surface of the basecoat film III, and

(2.1) partly curing it alone,

(2.2) partly curing it together with the basecoat film III, or

5 (2.3) fully curing it together with the basecoat film III,

thermally and, if desired, with actinic radiation, and

10 (3) applying a further clearcoat film II of a coating material II durable thermally and, if desired, with actinic radiation to the surface of the clearcoat film(s) I,

15 (4) and then curing

(4.1) the clearcoat films I and II and the basecoat film III together or

20 (4.2) the clearcoat film II alone,

thermally and, if desired, with actinic radiation,

25 characterized in that the coating material II and/or the coating material I, especially the coating material II, is a coating material as claimed in any of claims 1 to 11.

16. A process for producing a multicoat color and/or effect paint system ML on a primed or unprimed substrate by

5 (1) applying at least one color and/or effect basecoat film III of a pigmented coating material III curable thermally and, if desired, with actinic radiation to the surface of the substrate, and drying it  
10 without curing,

15 (2) applying at least one clearcoat film I of a coating material I curable thermally and, if desired, with actinic radiation to the surface of the basecoat film III, and

20 (2.1) partly curing it alone,  
(2.2) partly curing it together with the basecoat film III, or  
(2.3) fully curing it together with the basecoat film III,

25 thermally and, if desired, with actinic radiation, and

(3) applying a further clearcoat film II of a coating material II curable thermally and, if desired, with actinic radiation to the surface of the clearcoat film(s) I,

(4) and then curing

5 (4.1) the clearcoat films I and II and the  
basecoat film III together or

(4.2) the clearcoat film II alone,

10 thermally and, if desired, with actinic  
radiation,

15 characterized in that the coating material II  
and/or the coating material I, especially the  
coating material II, is a coating material as  
claimed in any of claims 1 to 11.

17. The use of the coating material as claimed in any  
of claims 1 to 11, of the clearcoat system KL as  
claimed in claim 12, of the clearcoat system KL  
produced as claimed in claim 13, of the multicoat  
20 paint system ML as claimed in claim 14, and of the  
multicoat paint system produced as claimed in  
claim 15 in automotive OEM finishing and  
automotive refinish, industrial coating, including  
coil coating and container coating, the coating of  
25 plastics, and furniture coating.

18. Primed or unprimed substrates comprising at least  
one clearcoat system KL as claimed in claim 12,  
one clearcoat system KL produced as claimed in

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claim 13, one multicoat paint system ML as claimed  
in claim 14 and/or one multicoat paint system ML  
produced as claimed in claim 15.

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